As was pointed out in detail in the previous response, a primary difference between the present invention and the prior art resides in the provision of an electroplated or electrolessly plated metal plating layer disposed on and adhering to an upper conductor structure layer. Such a metal plating layer has been found to offer significant benefits compared to the prior art. Thus, as is stated at page 12, lines 14-15 of the specification, the provision of such a metal plating layer acts to prevent the appearance of projections such as shown at 1010 and 1116 in Figures 1 and 2 of the application drawing. As stated at page 13, lines 3-7 of the specification, the provision of such a metal plating layer additionally serves to prevent the appearance of voids such as shown at 1011, 1012, 1117 and 1219 in Figures 1-3 of the application drawing. As further stated in the specification, the provision of such a metal plating layer serves to substantially eliminate electromigration, stress migration and contact migration tendencies in a semiconductor device.

In the prior art rejections, the reference which is particularly relied upon with respect to the claim recitations of an electroplated or electrolessly plated layer is the U.S. Patent to Howard. The Examiner recognizes that Howard discloses a metal conductive layer formed above a nitride layer and an additional nitride layer formed above the metal layer. In the rejection set forth on page 2 of the Action, the Examiner recognizes that Howard does not disclose an electroplated or electrolessly plated layer, but seeks to

justify the rejection by the assertion that what Howard teaches is "just another method to prevent void (crack) beside electroplating or electrolessly plating."

Thus, applicant and the Examiner are in agreement that, with respect to this feature of devices according to the present invention, the metal plating layer defined in the claims of the present application is different from the corresponding layer disclosed by Howard.

However, applicant and the Examiner disagree as to (1) whether the disclosure of Howard provides an acceptable basis for rejecting the application claims, and (2) whether the layer structure disclosed by Howard represents simply another technique to prevent, inter alia, voids, or cracks.

Regarding the first point, it is submitted to be well recognized that a claim defines a patentable advance over the prior art if it includes any feature which is not taught by the prior art.

Indeed, a consistent line of decisions by both the courts and the Board of Patent Appeals and Interferences has established that an improved result is not a requisite of patentability and that in order to support a prior art rejection, evidence relating to each claimed feature must be provided.

One decision which relied on this principle was In re Freed, 165 U.S.P.Q. 570, 571 (C.C.P.A., 1970), where the application claimed a process in which two steps are performed simultaneously. The applied reference disclosed performing the

two steps separately and both the Examiner and the Board of Appeals held that performing the two steps simultaneously was obvious in view of the disclosure of the reference. This holding was reversed by the Court, which indicated that "a determination of obviousness must be based on facts and not on unsupported generalities." Freed was cited in In re Saether, 181 U.S.P.Q. 36, 40 (C.C.P.A., 1974), in which a holding by the Board that the difference between the claimed invention and the references represent merely "the physical requirements of the users" was reversed because, in the Court's view, some evidence in support of that decision must appear in the record.

In re Boe, et al., 184 U.S.P.Q. 38 (C.C.P.A., 1974) cited Saether in a case involving a claim which recited "filaments at least partly composed of a segmented elastomer" and in which the Examiner had not cited any reference showing segmented elastomer. The Examiner's rejection was reversed on the basis that it ignored a specific claim limitation.

Boe, et al., was, in turn, relied upon in Ex parte Murphy, et al., 217 U.S.P.Q. 479, 81 (Bd. of App., 1982). In this case, the application claim recited a hollowed spike of hard material fitted on the flanged end of the hollow stem of resilient material, and no prior art was cited to show such a structure. The Board stated that since all limitations of a claim must be considered in determining the claimed subject matter, and it is error to ignore specific limitations distinguishing over the reference, it is necessary that the modification of a prior art device to meet the claim be obvious

from teachings in secondary references when taken in conjunction with the level of skill of those having ordinary skill in the art.

Similarly, in Ex parte Parthasarathy, et al., 174 U.S.P.Q. 63 (Bd. of App., 1971), the Board reversed the rejection, stating that nowhere in the record has the Examiner indicated any reason for finding obvious the alteration relative to the applied reference. In Ex parte Copping, 180 U.S.P.Q. 475, 76 (Bd. of App., 1972), the Board reversed the rejection, noting that the Examiner admits that limitations in the last three lines of the claim on appeal are not disclosed by the prior art, although the Examiner asserted that there has been no showing of an unobvious or improved result. The Board held that the prior art does not provide a factual basis to support a holding of obviousness.

In Ex parte Kaiser, 194 U.S.P.Q. 47 (Bd. of App., 1975), a claim was rejected even though the prior art did not disclose a claimed feature, which related to transistor emitter strips of different widths, the prior art disclosing strips of equal width. In reversing the rejection, the Board pointed out that the absence of an improved result is not conclusive of unpatentability and that the Examiner had not advanced any factual reason for a finding of obviousness.

Also of interest is the decision In re Fine, 5 U.S.P.Q. 2d 1596, 1599 (C.A.F.C., 1988).

Applying these principles to the present case, each of claims 1 and 21 recites "an electroplated or electrolessly

plated metal plating layer" disposed on and adhering to a previously recited layer, or formed in a through opening. The reference relied upon with respect to this feature, the U.S. Patent to Howard, discloses a layer which is not an electroplated or electrolessly plated metal plating layer. Thus, with regard to this feature, the Examiner has provided no evidence that it is known in the art, per se, or, more specifically, in the form of a conductive layer of a semiconductor device. Therefore, the prior art rejections of record are not supported by the evidence relied upon by the Examiner.

Moreover, the present invention is based on applicant's discovery that a metal plating layer of the type defined in each of claims 1 and 21 produces unexpected improvements compared to conductive layers formed according to the teachings of Howard, which are formed by evaporation or sputtering.

The layers disclosed in the Howard reference are formed by depositing a material in the form of particles which form a layer analogous to a covering of snow, whereas electroplating or electrolessly plating results in the formation of a film which has a high degree of continuity and homogeneity. As a result, an electroplated or electrolessly plated layer creates a significantly greater degree of step coverage and adhesion to the underlying surface than can be achieved by evaporation or sputtering. The superior step coverage resulting from electroplating or electrolessly plating

results in lower stress levels within the plating layer, with a substantially reduced tendency to form pores or voids. Moreover, the superior step coverage provided by such metal plating layers prevents atoms within the plating layer from concentrating at certain locations, resulting in a minimization of electromigration.

Thus, the semiconductor devices defined in the claims of the present application have properties superior to devices fabricated according to the teachings of the prior art, including the teachings of Howard.

Accordingly, it is submitted that the prior rejections now of record cannot stand and it is therefore requested that these rejections be reconsidered and withdrawn.

On page 3 of the Action, the Examiner rejects claims 5-7, 10, 13 and 22 under 35 U.S.C. § 112, second paragraph, as being indefinite, and further indicates that this is a restatement of a previous rejection. In particular, the Examiner asserts that the reason for this rejection was set forth in the first rejection, paper no. 9. Since applicant's copy of the previous rejection does not include a paper number, it must be assumed that the Examiner is referring to the Office Action mailed on June 6, 1989. However, in the Action of June 6, 1989, only claim 22 was rejected under 35 U.S.C. § 112, second paragraph; claims 5-7, 10 and 13 were rejected under 35 U.S.C. § 112, fourth paragraph, a ground of rejection distinctly different from one presented under the second paragraph.

In response to the rejection of claim 22 under 35 U.S.C. § 112, second paragraph, it was pointed out, in the amendment filed September 1, 1989, that claim 22 refers, in fact, to "said conductor structure component" and claim 21 recites only a single "conductor structure component". Since the Examiner has not commented on this response to the formal rejection of claim 22, counsel is unable to evaluate the basis for this continued rejection. As regards claims 5-7, 10 and 13, since they were not previously rejected under 35 U.S.C. § 112, second paragraph, and the Examiner has not indicated why these claims are considered indefinite, counsel is unable to formulate a meaningful response to that rejection.

As concerns the formal rejection applied to those claims in the first Action, it can only be reiterated that the limitations appearing in these claims do further limit the structure of claim 1 in that claims 5, 6 and 7 each defines the metal plating layer in a manner which can be considered to be structural, the recitations in claim 10 further delimit the structure of the metal plating layer, and claim 13 is clearly directed to the composition of the metal plating layer. Indeed, for reasons advanced above, the fact is that a metal plating layer differs physically from the layer disclosed by Howard, from which it results that each of these claims does define a structural distinction over the prior art.

Finally, note has been taken of the other references relied upon in the various rejections. Since, however, Howard is the only reference relied upon by the Examiner in connection

with the feature asserted herein to distinguish over the prior art, a detailed discussion of the subject matter of the other references does not appear to be required. To the extent that it may be considered necessary, the discussion presented in the previous amendment is incorporated herein by reference.

Accordingly, it is requested that the rejections of record be reconsidered and withdrawn, that all of the claims now in the application be allowed, and that the application be found in allowable condition.

If for any reason, the Examiner finds the application in other than in condition for allowance, he is respectfully requested to call the undersigned attorney at the Washington, D.C. telephone number 223-5700 to discuss the steps necessary for placing the application in condition for allowance.

March 19, 1990 Respectfully submitted,
(Date)

Jay M. Finkelstein
(Registration No. 21,082)

SPENSLEY HORN JUBAS & LUBITZ
Suite 500
1880 Century Park East
Los Angeles, California 90067
(213) 553-5050
(202) 223-5700